Math 392 Quiz 4B

June 25, 2019

Name: ______________________________

Instructions: No calculators! Answer <u>all</u> problems in the space provided! Do your rough work on scrap paper.

1. If $\vec{F} = < P(x,y,z), Q(x,y,z), R(x,y,z) >$, define $div\vec{F} =$ ______________________________

2. Let S_1 be a surface parametrized by $\vec{r}(u,v)$. Find a formula for a normal vector $\vec{n}_1$ to S_1: $\vec{n}_1 =$ ______________________________

3. Let S_2 be a surface given by $z = h(x,y)$. Find a formula for a normal vector $\vec{n}_2$ to S_2: $\vec{n}_2 =$ ______________________________

4. What is the formula to compute the area of S_1 over a region R. $A =$ ______________________________

5. What is the formula to compute the area of S_2 over a region D. $A =$ ______________________________

6. Let $\vec{F} = < -x^2, 0, 2xz - \cos x >$.

   (a) Compute $div\,\vec{F} =$ ______________________________

   (b) Does $\vec{F}$ have a vector potential? ______________________________ (Yes/No)

   (c) If your answer above is "No", write "DNE" in the space provided. If "Yes", then find a vector potential $\vec{G}$ for $\vec{F}$. In doing so, you may assume the z-coordinate of $\vec{G}$ is 0, and set arbitrary constants of integration to 0 when convenient/appropriate.

   $\vec{G} =$ ______________________________

7. Set-up integrals, with specific limits, to compute the areas of the following surfaces:

   (a) $\vec{r}(s,t) = < st, s+t, s-t >, 0 \leq s,t \leq 1$: $A =$ ______________________________

   (b) The part of the hyperbolic paraboloid $z = y^2 - x^2$ that lies between the cylinders $x^2 + y^2 = 1$, and $x^2 + y^2 = 4$:

   $A =$ ______________________________

Bonus:

1. For S_1 above, define $\iint_{S_1} f(x,y,z)dS =$ ______________________________

2. For S_2 above, define $\iint_{S_2} f(x,y,z)dS =$ ______________________________

(In this quiz, the less shorthand the better. Use as many variables as possible. For example, when writing a formula for which you need a normal vector $\vec{n}$, don't just write "$\vec{n}$", but rather the formula used to find it.)